

## **DETAILED ACTION**

### **Response to Decision on Appeal**

1. This office action is in response to a decision from the Board of Patent Appeals and Interferences filed on 2/2/2011.
2. Claims 1-20 have been reversed.

### ***Examiner's Amendment***

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it **MUST** be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Robert Scotti on February 14, 2010.

Amend claims 3, 19 and 20 as follows:

Claim 3: "Computer-readable storage media having stored thereon programming code executable at least in part on graphics accelerating hardware on a computer to perform processing of a radiance transfer coefficients computation for a set of points sampled over a modeled object for use in rendering images of the object, the computer-readable storage media not consisting of a signal, the programming code comprising:..."

Claim 19: "The computer-readable storage media of claim 3..."

Claim 20: "The computer-readable storage media of claim 3..."

**Allowable Subject Matter**

Claims 1-20 are allowed. The following is an examiner's statement of reasons for allowance: In regards to claim 1, the prior art fails to teach or suggest creating an object positions texture containing, a set of data values representing positions of a set of points sampled over the object mapped into a texture space; creating an object normals texture containing a set of data values representing normals of the set of sampled points mapped into the texture space; iteratively, for each of a set of directions sampled about the object, rendering the object from the direction to produce a shadow buffer representing depth from the object in the direction for the set of points; as a texture-based operation using the graphics processing unit, determining cosine terms of the set of sampled points for the currently iterated direction based on the normals represented in the object normals texture and currently iterated direction; as a texture-based operation using the graphics processing unit, determining shadowing of the set of sampled points for the currently iterated direction based on the depths represented in the shadow buffer and positions represented in the object positions texture; as a texture-based operation using the graphics processing unit, determining radiance transfer contribution of the set of sampled points for the currently iterated direction based on the determined cosine terms and shadowing; and accumulating the radiance transfer contributions of the set of sampled points for the currently iterated direction with that of previously iterated directions; producing a radiance transfer value for each of the sampled points from the accumulated radiance transfer contributions for the iterated directions at the respective sampled points; rendering an image of the object in a lighting environment based on the accumulated radiance transfer contributions; and presenting the image, therefore claims 1, 4 and 6-12 are allowable.

In regards to claim 2, the prior art fails to teach a memory for storing program code of at least one pixel shader and a radiance transfer coefficients processing program; a central processing unit operating to execute the radiance transfer coefficients processing program; a graphics processing unit programmable by and operating to execute the at least one pixel shader; wherein the radiance transfer coefficients processing program, executing on the central processing unit creates an object positions texture that contains data values representing positions of a set of points sampled over the object mapped into a texture space, and creates an object normals texture that contains data values representing normals of the set of sampled points mapped into the texture space; wherein the at least one pixel shader executing on the graphics processing unit performs texture operations that iteratively, for each of a set of directions sampled about the object, render the object from the direction to produce a shadow buffer representing depth from the object in the direction for the set of points; determine cosine terms of the set of sampled points for the currently iterated direction based on the normals represented in the object normals texture and currently iterated direction; determine shadowing of the set of sampled points for the currently iterated direction based on the depths represented in the shadow buffer and positions represented in the object positions texture; determine radiance transfer contribution of the set of sampled points for the currently iterated direction based on the determined cosine terms and shadowing; and accumulate the radiance transfer contributions of the set of sampled points for the currently iterated direction with that of previously iterated directions; and wherein the graphics processing unit produces a radiance transfer value for each of the sampled points from the accumulated radiance transfer contributions for the iterated directions at the respective sampled points, therefore claims 2, 5 and 13-18 are allowable.

In regards to claim 3, the prior art fails to teach computer-readable storage media having stored thereon programming code executable at least in part on graphics accelerating hardware on a computer to perform processing of a radiance transfer coefficients computation for a set of points sampled over a modeled object for use in rendering images of the object, the computer-readable storage media not consisting of a signal, the programming code comprising: code means executable on a computer for creating an object positions texture that contains data values representing positions of a set of points sampled over the object mapped into a texture space; code means executable on a computer for creating an object normals texture that contains data values representing normals of the set of sampled points mapped into the texture space; code means executable on the graphics accelerating hardware of the computer to perform texture-based operations that iteratively, for each of a set of directions sampled about the object, render the object from the direction to produce a shadow buffer representing depth from the object in the direction for the set of points; determine cosine terms of the set of sampled points for the currently iterated direction based on the normals represented in the object normals texture and currently iterated direction; determine shadowing of the set of sampled points for the currently iterated direction based on the depths represented in the shadow buffer and positions represented in the object positions texture; determine radiance transfer contribution of the set of sampled points for the currently iterated direction based on the determined cosine terms and shadowing; and accumulate the radiance transfer contributions of the set of sampled points for the currently iterated direction with that of previously iterated directions; and code means executable on the computer to produce a radiance transfer value for each of the sampled points from the

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accumulated radiance transfer contributions for the iterated directions at the respective sampled points, therefore claims 3, 19 and 20 are allowable.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

### **Conclusion**

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Said Broome whose telephone number is (571)272-2931. The examiner can normally be reached on M-F 8:30am-5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Andrew Wang can be reached on (571)272-0811. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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/Said Broome/  
Primary Examiner, Art Unit 2628